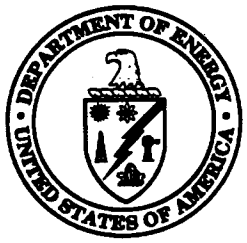
PROJECTIONS FOR U.S. AND GLOBAL SUPPLY AND DEMAND FOR 2010 AND 2020



By

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Presented at:

U.S. and China Oil and Gas Industrial Forum
Beijing, People's Republic of China
November 2-4, 1998

As one of our famous fictional detectives used to say "just the facts." My presentation will review the historic statistics and the projections for; global oil supply and demand, several comparisons of energy in the United States and China, United States fuel use for all fuels, a specific look at oil and natural gas supplies for the United States, and finally a look at how petroleum companies' spending is going up while their costs are going down.

The statistics and projections I will be presenting were prepared by the Department of Energy's Energy Information Administration. The EIA is responsible for the collection of energy information in the United States, as well as the interpretation of those statistics, and the projections derived from those statistics.

First the world:

World Oil Consumption in Three Cases **[EXHIBIT 1]**

- In the early 1990s, oil demand was relatively flat: oil consumption worldwide was only 1 million barrels per day higher in 1993 than it was in 1989. Since 1993, however, the world's demand for oil has risen by almost 7 million barrels per day, to 73.7 million barrels per day in 1997.

- The *International Energy Outlook 1998 (IEO98)* reference case projections show large increases in oil demand. Between 1995 and 2020, oil demand is expected to grow at an average rate of 2 percent per year, resulting in an increase of more than 40 million barrels per day relative to 1997. In 2020, world oil consumption is projected to exceed 115 million barrels per day.

- Regardless of the *IEO98* price scenario, oil demand rises significantly over the projection period. In the high and low world oil price cases, the projected rise in oil consumption ranges from a low of 25 to as much as 60 million barrels per day. There is now widespread agreement that resources are not a key constraint in satisfying increases in world oil demand to 2020. Rather more important are the political, economic, and environmental circumstances conditioning supply and demand development.

- Although there is substantial optimism in long-run expectations for world oil markets, current developments suggest potential challenges to demand-supply equilibrium. The onset of recession in Southeast Asia could slow oil demand growth in a region that has accounted for 40 percent of the growth in world oil demand since 1990.

World Oil Price and Proven Oil Reserves **[EXHIBIT 2]**

- Since 1980, world proven oil reserves have continued to increase even as the world oil price has fallen. In 1998, world proven oil reserves reached 1,019.5 trillion barrels of oil according to *Oil and Gas Journal* (compared to the 1970 level of 633.5 trillion barrels).

- New discoveries, additions, and revisions to reserves in the Middle East and the former Soviet Union have more than made up for reserve declines in the United States and the rest of the world.

World Oil Prices in Three Cases **[EXHIBIT 3]**

- Developments in the world's oil market have been particularly unusual. Recent oil prices have been weak in 1998—with prices hitting ten year lows during 1998. The Organization of Petroleum Exporting Countries (OPEC) increased oil production quotas for its members in late 1997 (although Saudi Arabia, Mexico, and Venezuela agreed to cut production levels in response to the weakness in world oil prices), and the United Nations increased the amount of oil Iraq is allowed to export.

- The long-term trend for world oil prices in the *IEO98* shows oil prices rising in real terms, reaching about $22 per barrel (in constant 1996 U.S. dollars) in 2020 from about $17 at the end of 1997. Current price movements have not modified EIA's intermediate and long-term price expectations. Three long-term price paths are posited. The year-end 1996 price was $24 per barrel. In the high world oil price case, prices reach $29 per barrel in 2020, and in the low world oil price case, prices remain low falling to $14 per barrel.

- General perceptions are that near-term price risks are more heavily weighted on the downside, rather than the upside; many analysts have lowered their near-term projections by $1 or more per barrel over at least the next year, a sharp reversal of the views held in early 1996

- In the next year or so, prices are expected to recover from present levels as the demand for oil begins to grow more rapidly, especially in the developing regions. Over the longer term, oil prices are expected to remain relatively low throughout the projection period.

- Limits to long-term price escalation include substitution of other fuels (such as natural gas) for oil, marginal sources of conventional oil (i.e., resources that are presently uneconomical to develop because they are located in areas that are difficult to reach or are too environmentally risky to develop, but where technology has advanced to a point where it may soon be possible to develop them) that become reserves when prices rise, and nonconventional sources of oil (e.g., tar sands or shale) that become reserves at still higher

prices. Advances in exploration and production technologies bring down the price where these additional resources become part of the reserve base. On the other hand, lower prices deter investment in exploration and development, causing the expansion of oil supply capabilities to be diminished. At the same time, low prices encourage increased oil use, so that reserves are consumed without being replaced through exploration activities.

Before we focus on energy in the United States, let's look at how energy use in our two countries is becoming more similar.

Energy Intensity: China and the United States, 1970-2020 **[EXHIBIT 4]**

- Energy intensity is defined as the energy consumed per dollar of gross domestic product.

- Energy intensity has fallen dramatically in China since 1980—by 8.0 percent per year between 1980 and 1995. It is expected to continue to decline over the forecast period—at the more modest rate of 1.9 percent per year as the country continues to adopt the more energy efficient technologies that are currently in use in the much less energy intensive industrialized world. The widespread use of efficient technology could come about through pressures for economic efficiency as China's economy becomes more market-driven and more integrated into the global economy.

- The contrast between energy intensity levels of the United States and China are striking even now. In 1995, energy intensity in the United States was approximately 14.4 thousand Btu per 1990 dollar, but in China—despite the strong decreases in intensity of the 1980s and 1990s—energy intensity was measured at 53.2 thousand Btu per 1990 dollar, close to 4 times the U.S. level. By 2020, China's energy intensity levels are expected to fall to less than half the 1995 level (23.9 thousand Btu per 1990 dollar).

Net Electricity Consumption per Capita: United States and China, 1970-2020 **[EXHIBIT 5]**

- Electricity consumption per person in China grew rapidly between 1970 and 1995, at an average annual rate of 6.9 percent, compared to the United States' growth of 2.4 percent per year over this same time period. Nevertheless, per capita electricity consumption in China remains substantially lower than in the United States. In 1995, net electricity per person in the United States was 11,842 kilowatthours per person compared to the Chinese level of 722 kilowatthours per person.

- Although electricity growth rates are declining in industrialized countries like the United States, absolute and per capita levels are expected to rise as new uses for electricity proliferate among residential, commercial, and industrial consumers. Per person electricity use is expected to continue to increase in both the United States and China, but in the United States, electricity per capita growth slows markedly to 0.2 percent per year between 1995 and 2020 in the *IEO98* reference case. In China, per capita growth also slows slightly, but remains high at 5.0 percent per year over the projection period. Even with these strong growth rates in China, net electricity consumption per capita is expected to be less than one-fifth that of the United States by 2020.

On to the United States:

U.S. Energy Consumption by Energy Source, 1995 and 2020 **[EXHIBIT 6]**

- Total U.S. energy consumption is expected to increase from 90.9 quadrillion Btu in 1995 to 118.6 quadrillion Btu in 2020. All energy sources except nuclear power are expected to grow. Electricity generation from nuclear power declines significantly over the projection period. Of the 101 gigawatts of nuclear capacity presently available, 52 gigawatts (or 65 nuclear power plants) are assumed to be retired by 2020, with no new plants constructed by 2020.

- Increases in petroleum product consumption occur mainly in the transportation sector, as increased light-duty vehicles traveled more than make up for increased vehicle efficiency over the forecast horizon. Continued economic growth is also expected to fuel increased petroleum use for air and freight travel and shipping through 2020.

- Natural gas is projected to be the fastest growing energy source in the United States over the 1995-2020 time period. Gas use grows by 1.6 percent per year over the forecast period, compared to 1.3 percent per year for oil; 1.1 for coal, -2.2 for nuclear, and 0.7 for renewable energy sources. Although natural gas use is expected to increase in all end use sectors, the fastest growth is expected to be use by electricity generators.

- Although coal-fired generation loses market share over the projection period, it accounts for more than one-half of electricity generation. Total coal consumption increases from 19.6 quadrillion Btu in 1995 to 25.6 quadrillion Btu in 2020. About 90 percent of U.S. coal is used for electricity generation.

- Renewable fuel use increases slowly over the projection period, at 0.7 percent per year. The largest share of renewable energy remains hydroelectricity. Since the growth of hydroelectricity is constrained by a lack of available new sites, high construction costs, growing environmental concerns, and competing uses for water resources, very little growth

is expected between 1995 and 2020. Expectations vary for nonhydroelectric renewable by 2020 is expected to account for about 2.5 percent of the U.S. grid-connected electricity supply.

U.S. Oil Consumption, Production, and Net Imports **[EXHIBIT 7]**

- U.S. petroleum supply declines in the *Annual Energy Outlook 1998*, as domestic crude oil production falls off. U.S. supply falls from 9.4 million barrels per day in 1996 to 8.5 million barrels per day by 2020. Advances in oil exploration and production techniques are not sufficient to offset declining resources.

- Additional petroleum imports will be needed to fill the widening gap between supply and consumption. By 2020, the United States will require 15.2 million barrels per day of oil to fill the gap between domestic supply and consumption, an increase of 71 percent over the 1996 gap of 8.9 million barrels per day. In 1996, net imports of petroleum climbed to 46 percent of U.S. petroleum consumption, matching the 1977 peak. Continued dependence on petroleum imports is projected, reaching 66 percent by 2020 in the reference case.

- Demand for petroleum is projected to grow by 1.3 percent per year in the United States between 1995 and 2020. In 2020, 72 percent of petroleum use is in the transportation sector, up from 66 percent in 1996. Increases in light-duty vehicle miles traveled more than offset the increases in vehicle efficiency throughout the projection period. Continued economic growth also increases petroleum use for air and freight travel, and shipping.

U.S. Natural Gas Consumption, Production, and Net Imports, 1970-2020 **[EXHIBIT 8]**

- U.S. natural gas consumption increases by an average of 1.6 percent per year, with increased demand in all sectors. The most rapid growth is in consumption by electricity generators (excluding cogenerators), which is projected to increase from 3.37 trillion cubic feet to 9.85 trillion cubic feet between 1995 and 2020.

- Gas production in the United States is expected to continue to increase throughout the forecast period. This increase comes primarily from lower 48-State, onshore nonassociated sources. Conventional onshore production—which accounts for about 42 percent of the current U.S. domestic production—increases in share to 45 percent of the total by 2020. Unconventional sources also increase in share, and gas from offshore wells in the Gulf of Mexico contributes significantly to production. The innovative use of cost-save technology and the expected continuation of recent huge finds, particularly in the deep water of the Gulf of Mexico, have encouraged greater interest in this area.

- Net gas imports are expected to grow in the forecast from 12.4 percent of the total gas consumption in 1996 to 15.2 percent in 2020. Most of the increase is attributable to imports from Canada, which are projected to grow substantially as considerable new pipeline capacity comes on line.

Now, I would like to look at how the major production companies in the United States are increasing their expenditures, both in the United States and outside the U.S. I will also look at how they are lowering their costs for finding and lifting petroleum.

Capital and Exploratory Expenditures for FRS Companies **[EXHIBIT 9]**

- The Financial Reporting System (FRS) companies must account for at least one percent of U.S. production or reserves of oil, natural gas, coal, or uranium or 1 percent of U.S. refining capacity of refined product sales.

- Most FRS companies are multinational and account for more than 80 percent of U.S. overseas investment in petroleum and natural gas.

- In 1997 the FRS companies were Amerada Hess, AMOCO, Anadarko Petroleum, Ashland Oil, ARCO, BP America, Burlington Resources, Chevron, Coastal, Conoco (DuPont), Enron, Exxon, Fina, Kerr-McGee, Mobil, Occidental Petroleum, Oryx Energy, Phillips Petroleum, Shell Oil, Sonat, Texaco, Union Pacific Resources, Unocal, and USX.

- Upstream oil and natural gas typically accounts for the bulk of annual capital spending of the FRS, major energy-related companies. In the 1995-1997 period, upstream has accounted for most of the growth in the majors' capital spending.

- The surge in downstream spending in the first half of the 1990s was driven in large part by environmental requirements mainly in the United States, but also in Europe.

- Chemicals is a core competency of most of the majors, but investment in chemicals and profitability of chemicals are highly cyclical.

- "Other" contains non-energy businesses, coal and other energy businesses. Non-energy has experienced a long-running retrenchment. Coal has been a target of divestiture in the 1990s. Other energy businesses include electricity and cogeneration which are investment targets for a minority of the companies.

Exploration Expenditures for FRS Companies **[EXHIBIT 10]**

- Foreign attractions include:
  - Larger field sizes (outside North America)
  - Opening of new areas for foreign investment in oil and natural gas exploration and production
  - Tax policy changes favorable to upstream investment
- Offshore attractions include:
  - Technological advances making deepwater development economic
  - Liberalized leasing policies in the Gulf of Mexico
  - More recently, royalty relief
- Onshore generally has been an area of retrenchment since the oil price crash of 1986. It is also characterized by small, uneconomic field sizes. Scattered holding has encouraged cost-cutting consolidations and spinoffs to smaller specialty companies.
- Nevertheless, technology and tax policy have made some onshore areas attractive:
  - Horizontal drilling: Williston Basin, Austin Chalk Trend
  - 3-D Seismic: Real formations in Texas, Louisiana, and Montana
  - Section 29 Tax Credits: coal bed methane in New Mexico and Louisiana

U.S. Onshore, U.S. Offshore, and Foreign Finding Costs for FRS Companies **[EXHIBIT 11]**

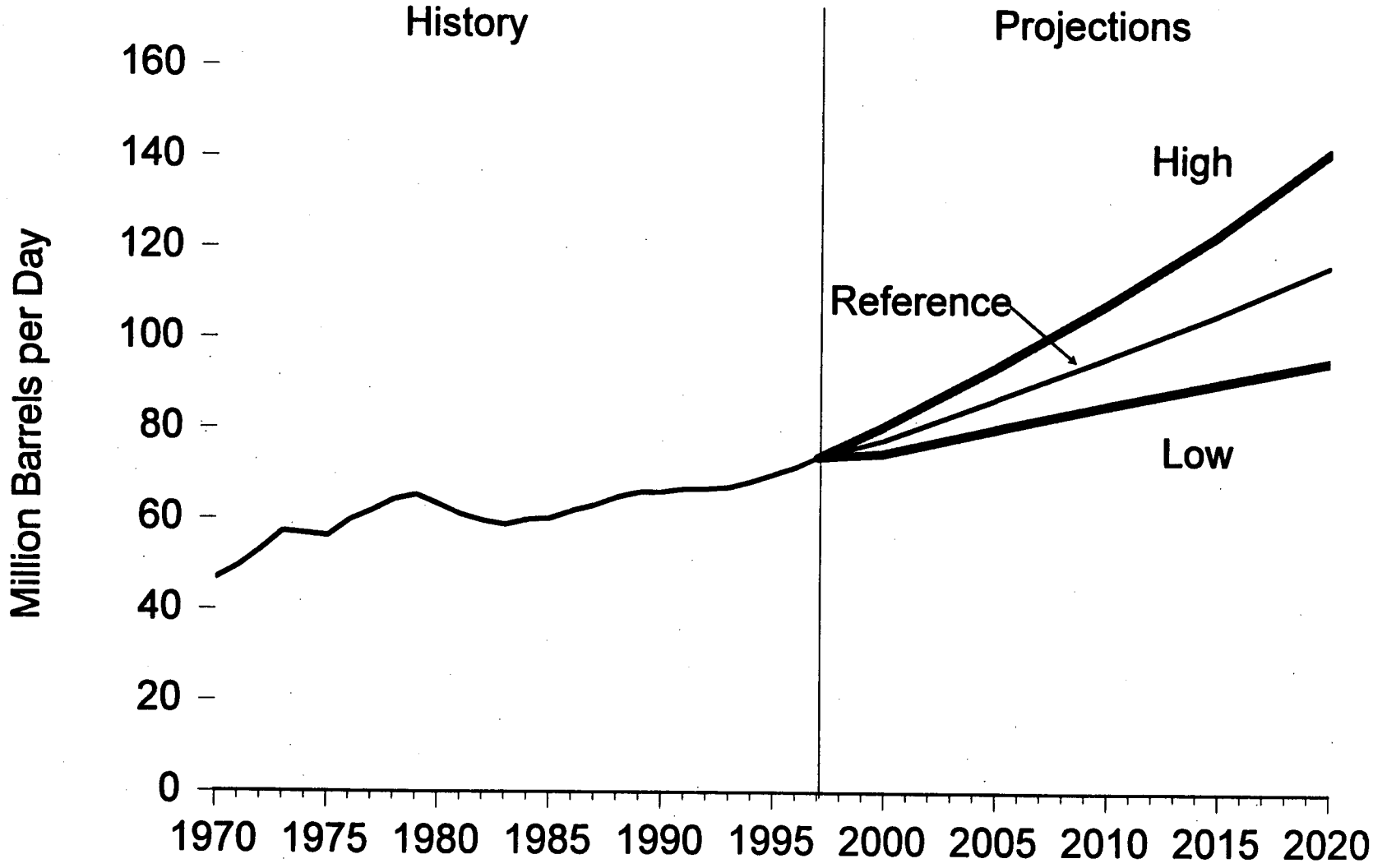
- Finding costs for the FRS companies include: oil field services (pre-1990s), project high grading, and technology advances.
- Prior to the 1990s, finding costs associated with oil field services included:
  - Leasing excess rig capacity
  - Oilfield unemployment
  - Opportunities for efficiency gains
- Finding costs associated with technology advances include:
  - Deepwater development
  - 3-D seismic
  - Horizontal drilling

Direct Oil and Gas Lifting Costs per BOE for FRS Companies **[EXHIBIT 12]**

- Cost-cutting measures include:
  - Divestiture of high cost fields
  - Consolidation of lease holdings
  - Reorganizations
  - Business applications of information technologies
- Technological advances include:
  - Horizontal drilling
  - Improved enhanced recovery techniques
  - Efficiencies in well workovers and multiple well completions

EXHIBIT 1

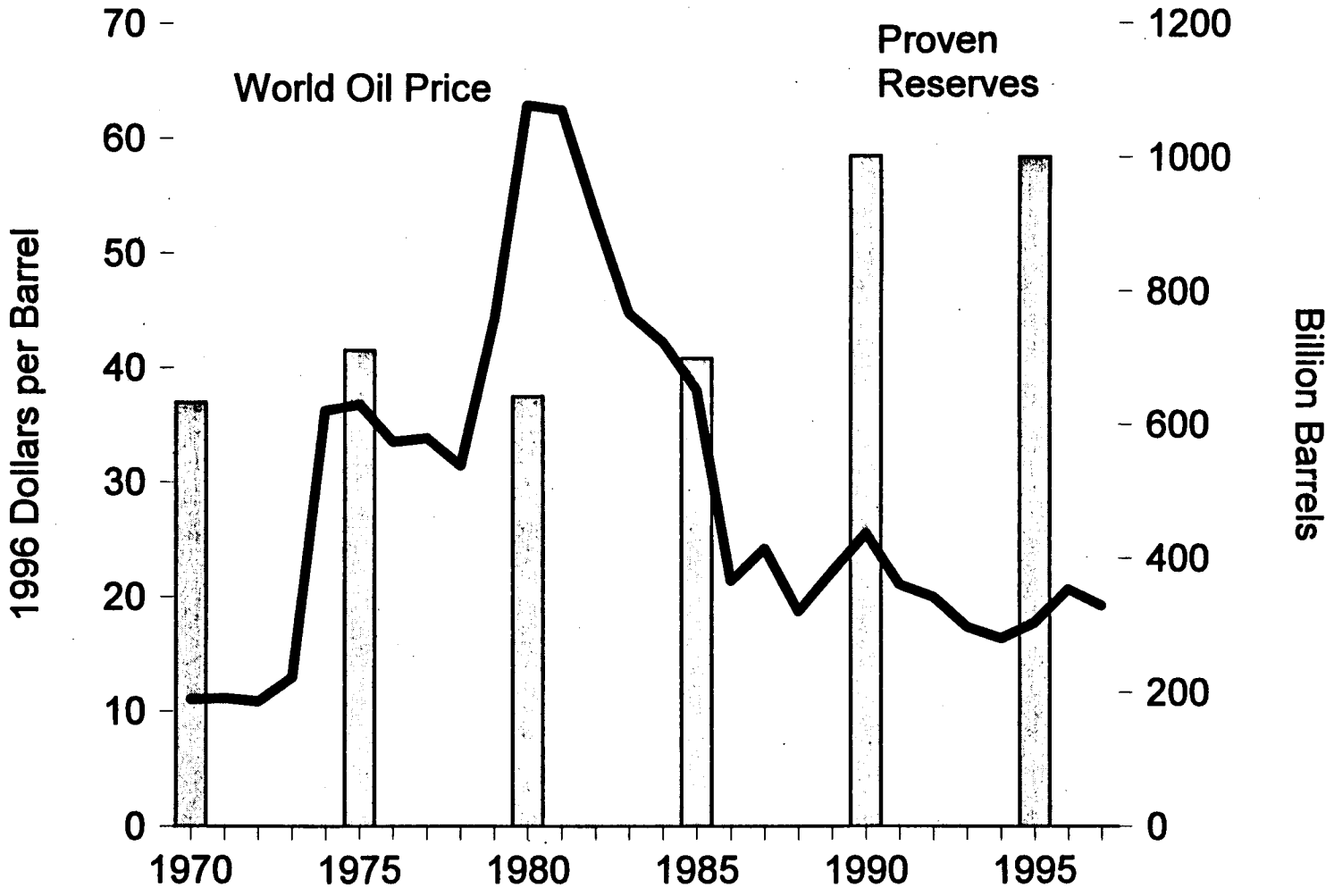
World Oil Consumption in Three Cases



Source: EIA, International Energy Outlook 1998

EXHIBIT 2

World Oil Price and Proven Oil Reserves



Source: EIA, International Energy Outlook 1998 and PennWell Publishing

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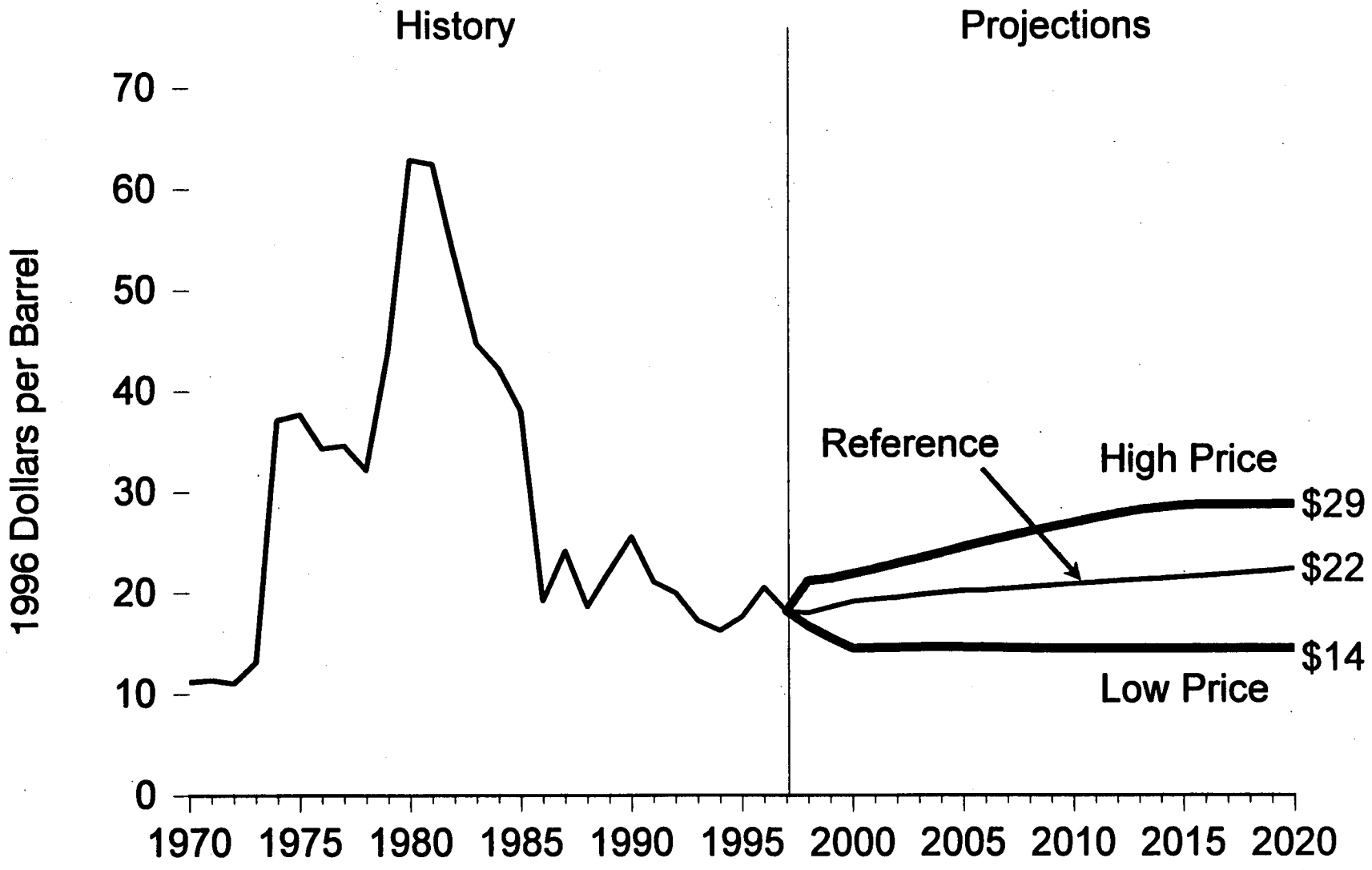
World Oil Prices in Three Cases



Source: EIA, International Energy Outlook 1998

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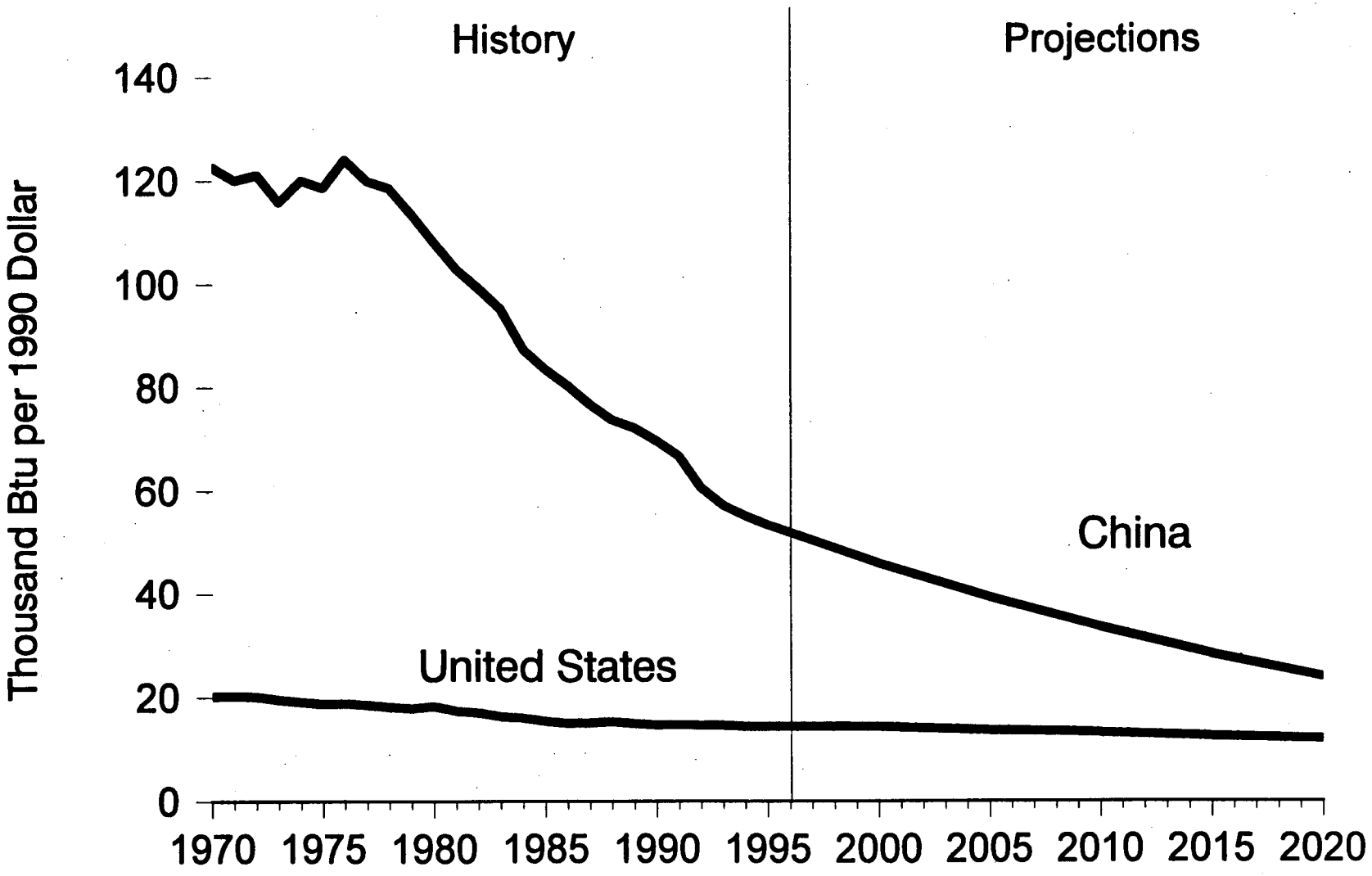
Energy Intensity: China and United States, 1970-2020



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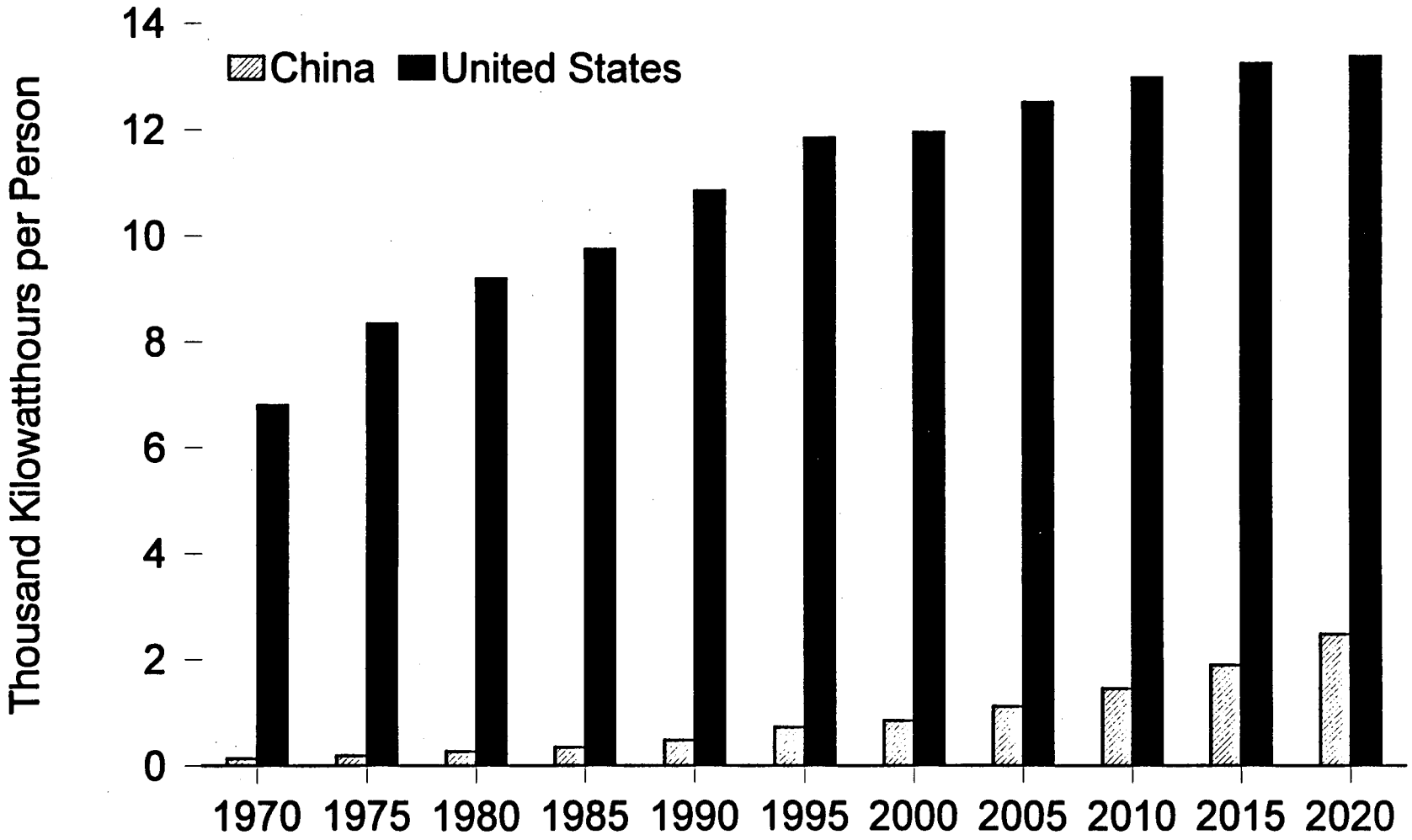
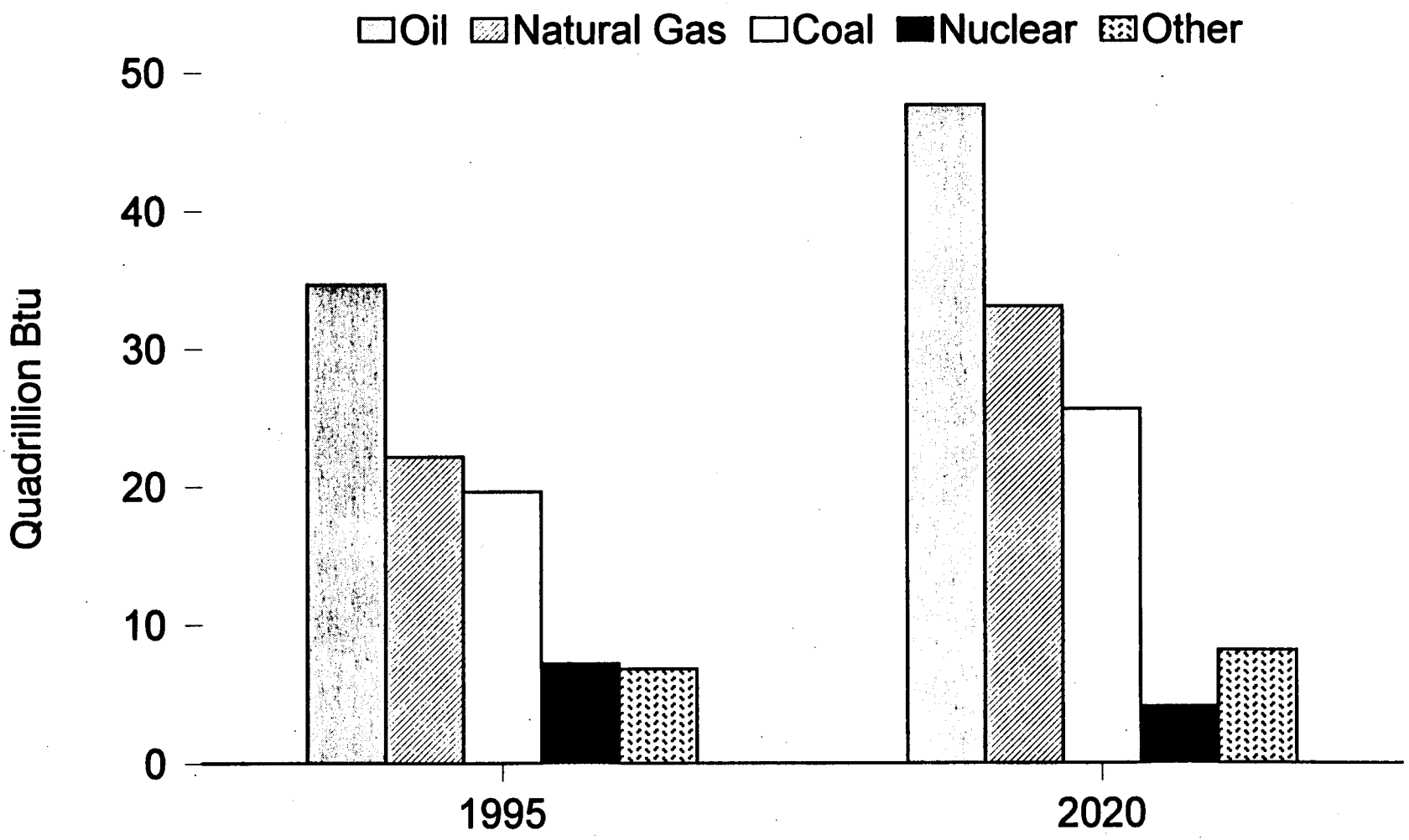


Source: EIA, International Energy Outlook 1998

EXHIBIT 6

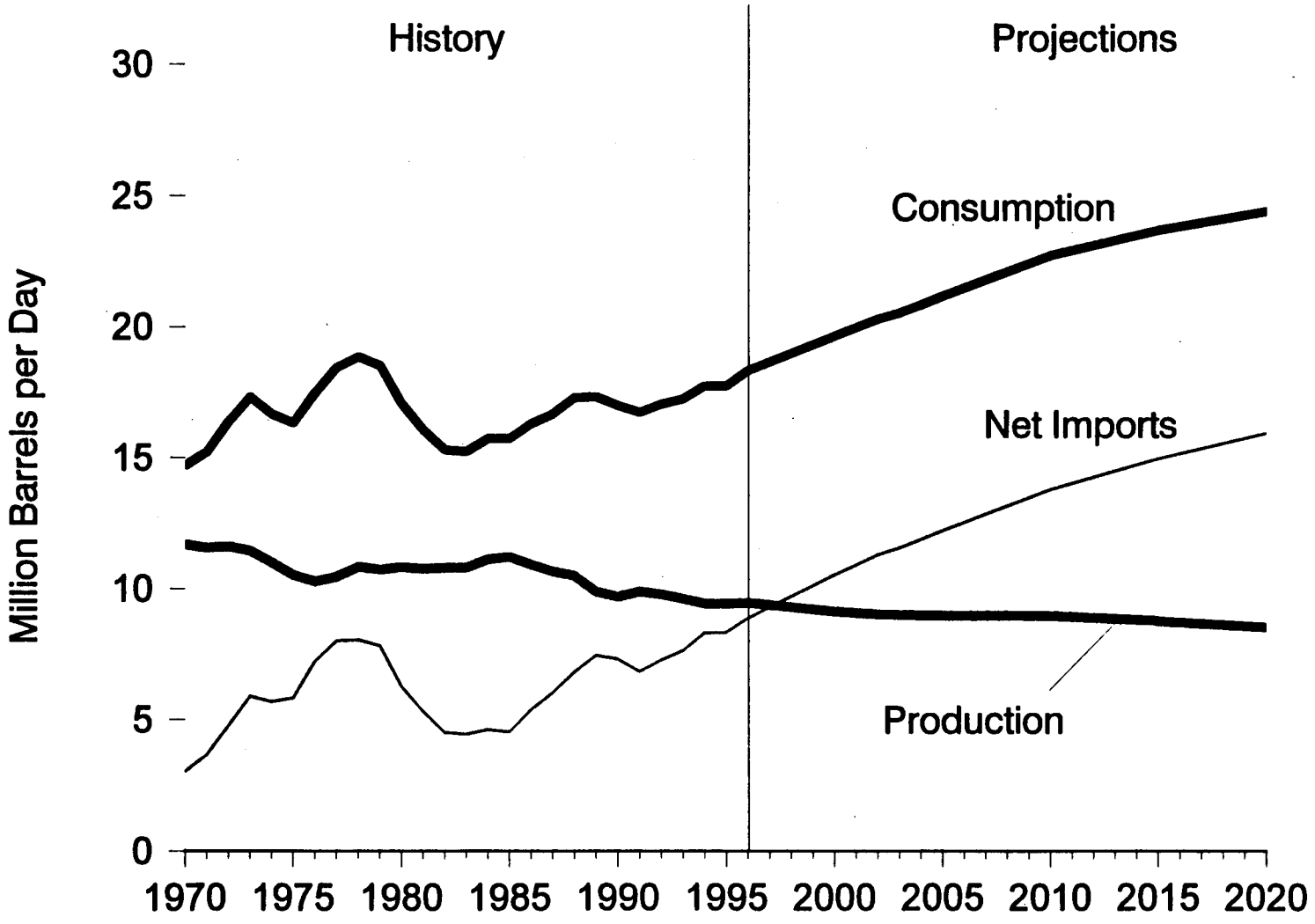
U.S. Energy Consumption by Energy Source, 1995 and 2020



Source: EIA, Annual Energy Outlook 1998

EXHIBIT 7

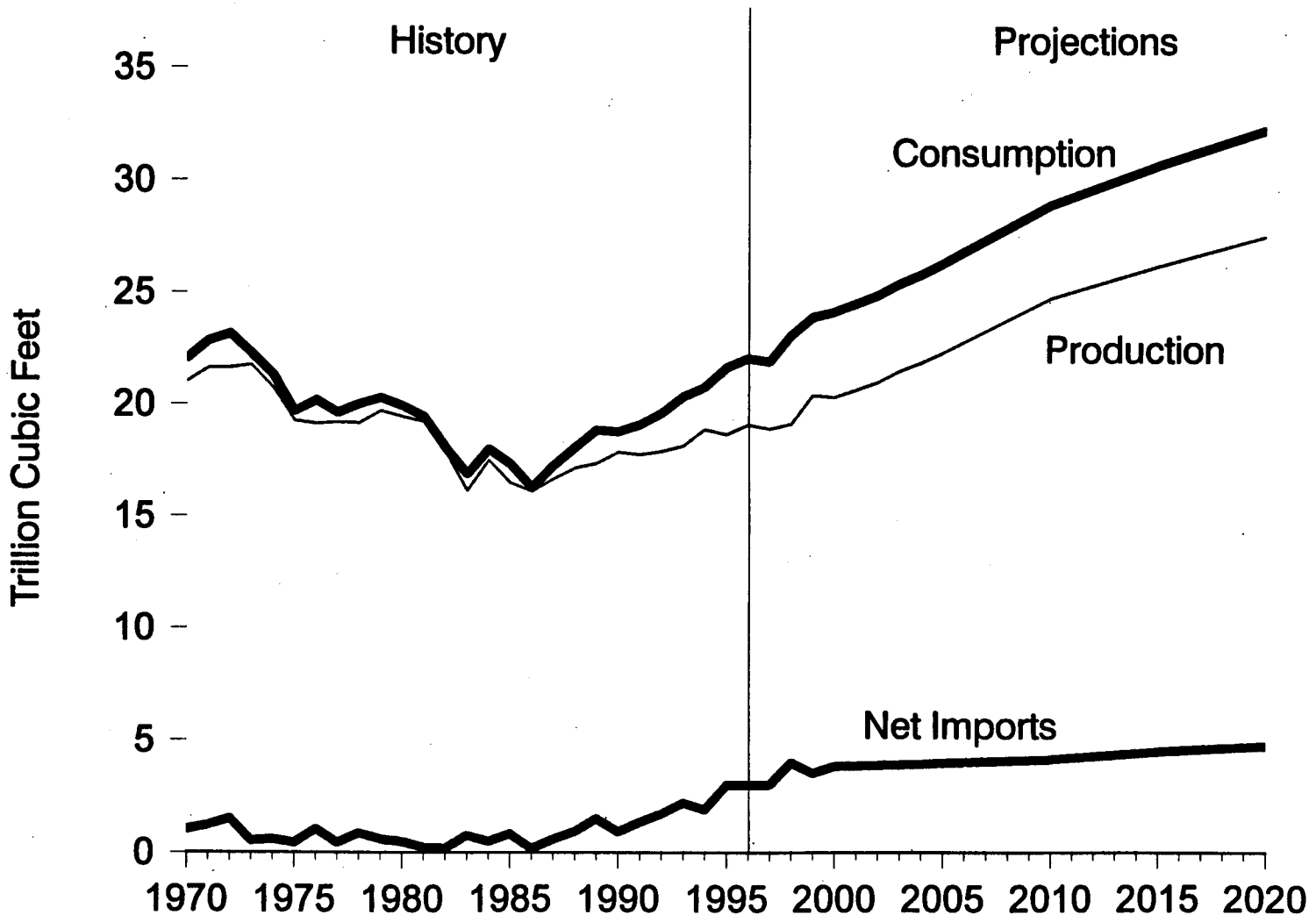
U.S. Oil Consumption, Production, and Net Imports, 1970-2020



Source: EIA, International Energy Outlook 1998

EXHIBIT 8

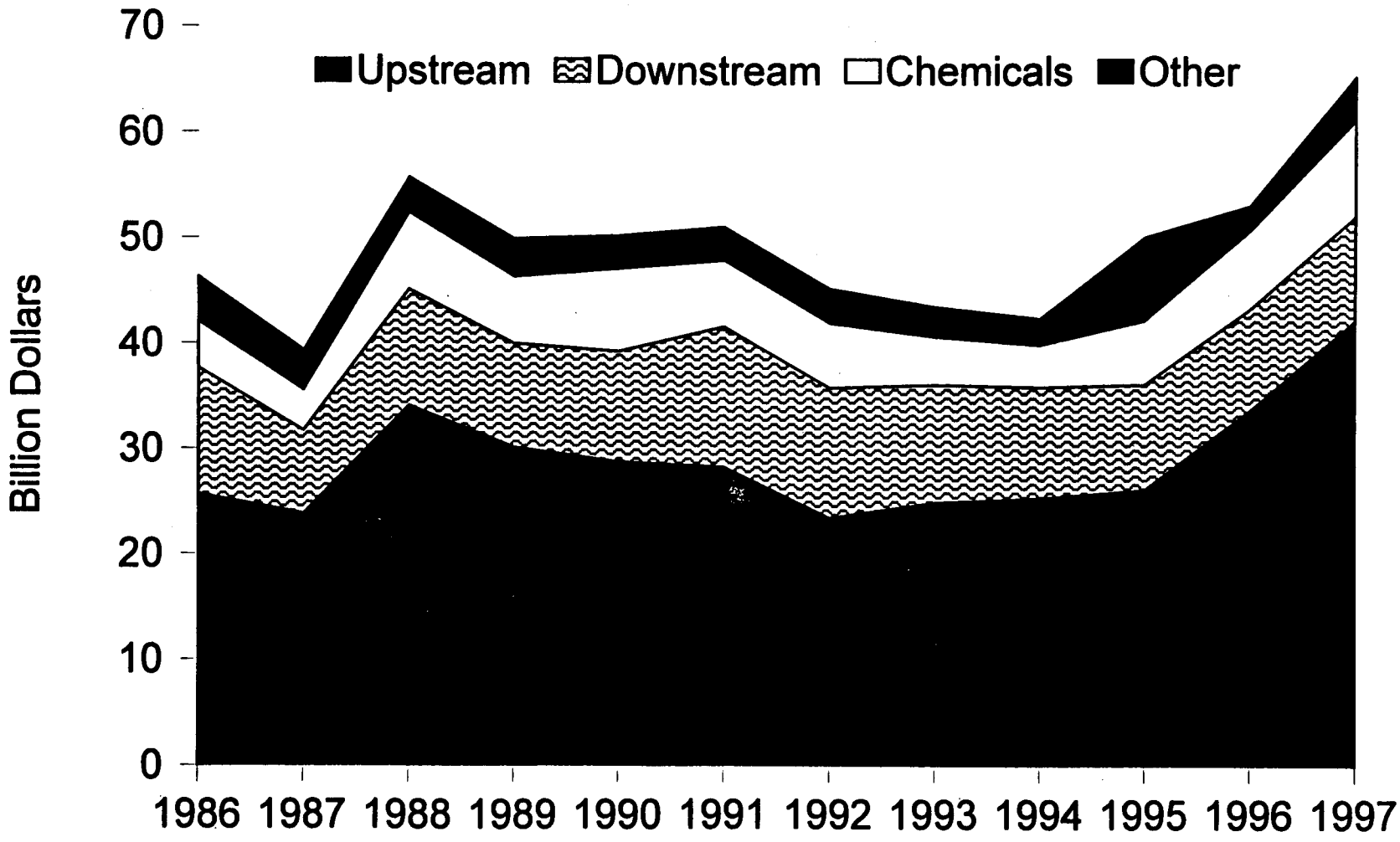
U.S. Natural Gas Consumption, Production, and Net Imports, 1970-2020



Source: EIA, History: Annual Energy Review 1997. Projections: Annual Energy Outlook 1998

EXHIBIT 9

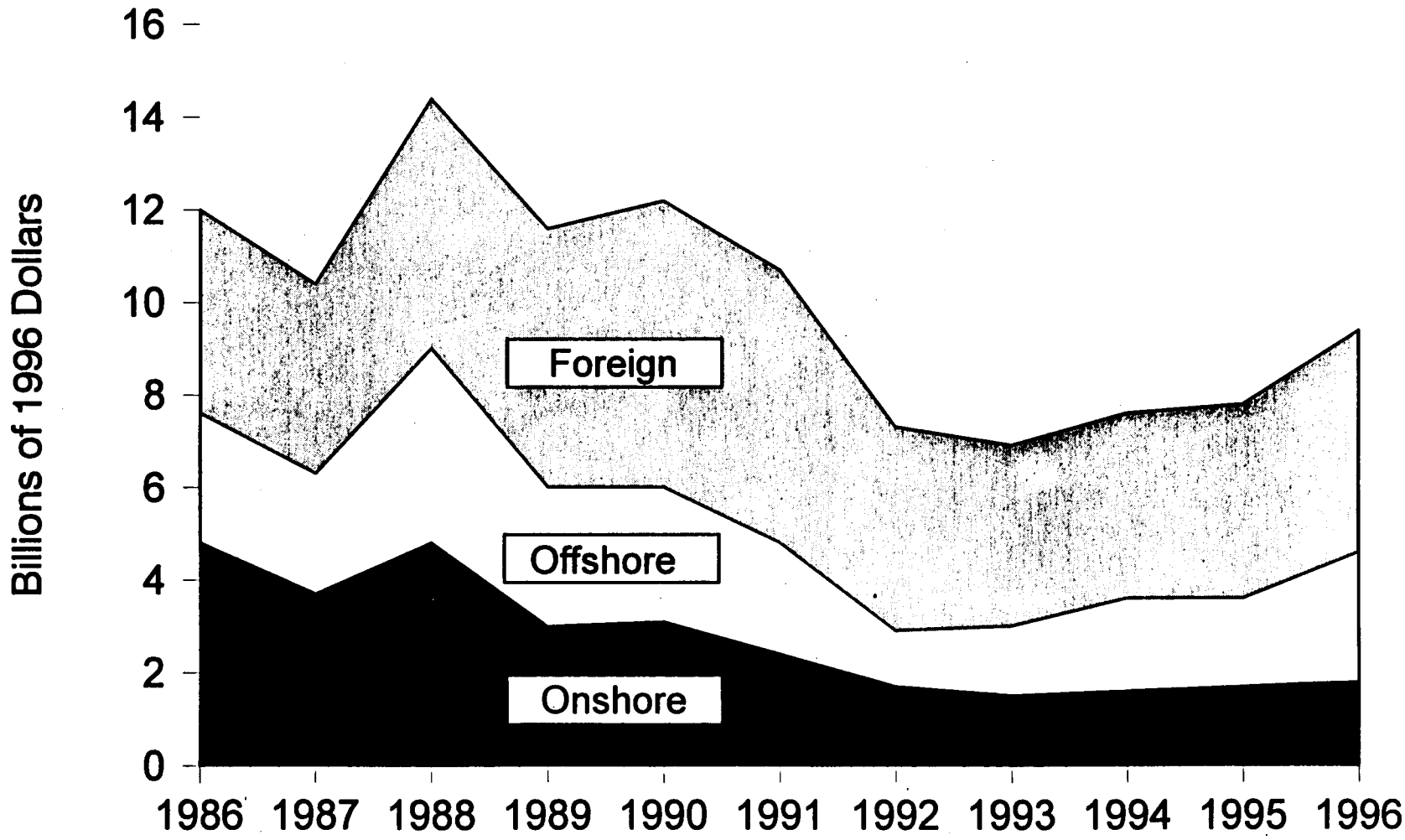
Capital and Exploratory Expenditures for Financial Reporting System Companies, 1986-1997



Source: EIA, Office of Energy Markets and End Use

EXHIBIT 10

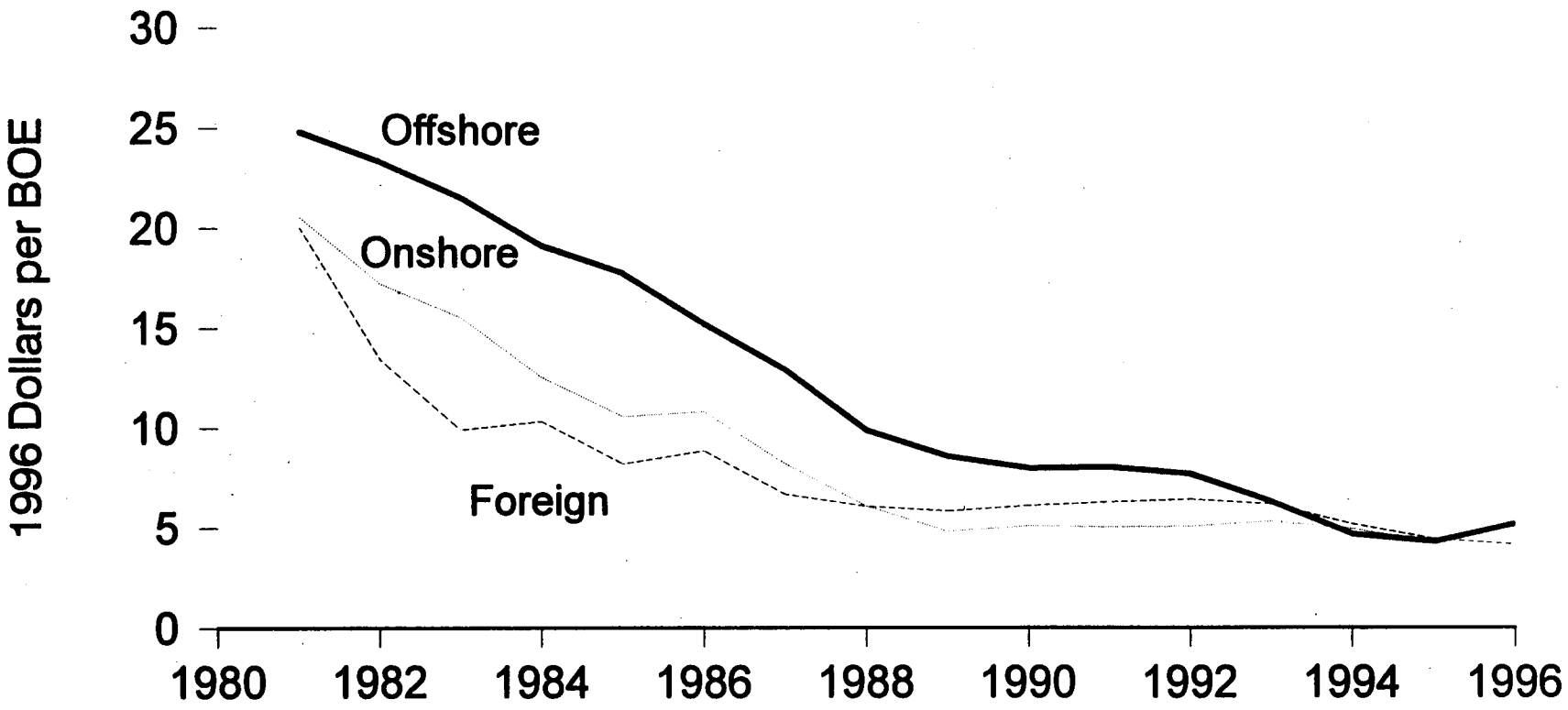
Exploration Expenditures for Financial Reporting System Companies, 1986-1997



Note: Includes expenditures for unproved acreage
Source: EIA, Form EIA-28, "Financial Reporting System"

EXHIBIT 11

U.S. Onshore, U.S. Offshore, and Foreign Finding Costs for Financial Reporting System Companies, 1981-1996



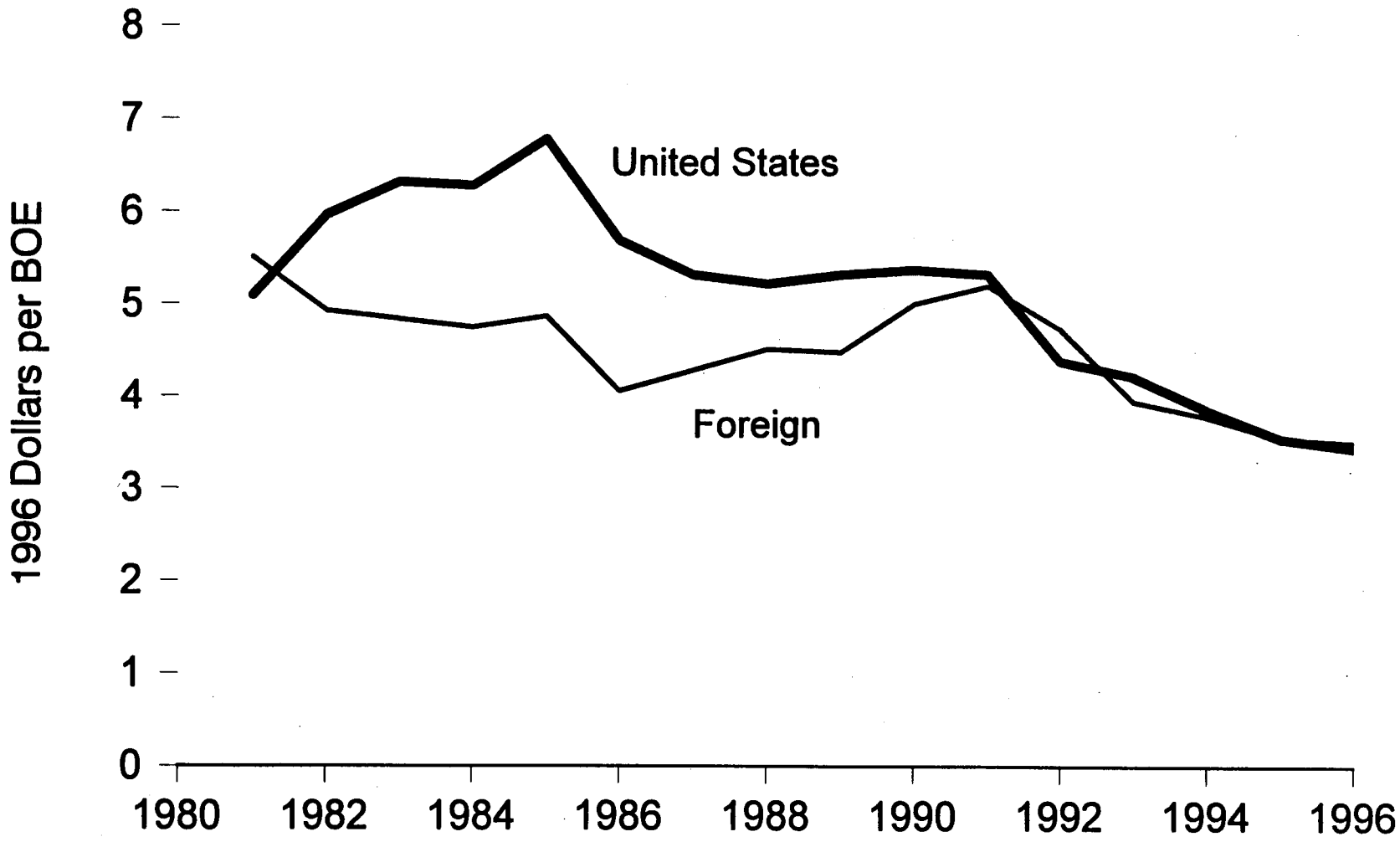
BOE = Barrels of Crude Oil Equivalent

Note: Finding Costs are 3-year weighted averages of exploration and development expenditures, excluding expenditures for proved acreage, divided by reserve additions, excluding net purchases. Expenditures are deflated using the chain-weighted GDP deflator. Reserve additions exclude the downward revisions of the natural gas reserves located on the north slope of Alaska, which occurred in the mid-1980s upon realization that the gas was not currently marketable.

Source: EIA, Form EIA-28, "Financial Reporting System"

EXHIBIT 12

Direct Oil and Gas Lifting Costs per BOE for Financial Reporting System Companies, 1981-1996



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